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Case Report

Endodontic treatment of a maxillary first molar having three mesiobuccal canals with the aid of spiral computed tomography: a case report

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Abstract: Variations in the dental anatomy are found in all teeth. Understanding root canal morphology is one of the most important steps in successful root canal treatment. Thus, during the diagnosis and treatment phases of maxillary molars, a clinician must be aware that anatomical variations exist. The purpose of this study is to present a clinical case of a maxillary first molar having three mesiobuccal canals with separate orifices. This unusual morphology was confirmed by spiral computed tomography (SCT). This article discusses the variations in canal morphology and the role of SCT in successfully diagnosing and negotiating them. (J Oral Sci 52, 495-499, 2010)

Keywords: maxillary first molar; spiral computed tomography; three mesiobuccal canals.

Introduction

Successful root canal therapy requires thorough knowledge of the root and root canal morphology. The most common form of the permanent maxillary first molar has three roots and four canals (1). A major cause of endodontic failure in the maxillary first molar is the inability to locate, debride and fill the frequently present second mesiobuccal canal (MB-2). Insufficient awareness of the anatomy of the teeth is one of the main reasons for failure of root canal therapy (2); knowledge of anatomical aberrations will markedly decrease the failure rate. For this reason, during the diagnosis and treatment phases of the maxillary molars, a clinician must be aware of anatomical variations (3).

The mesiobuccal root of the maxillary first molar has, perhaps, been studied and written about more than any other in the endodontic literature. Gorduysus had noticed that the MB-2 canal can be negotiated in 80% of maxillary molars (4). Although an orifice is apparent in 96% of the teeth, the ability to negotiate MB-2 is facilitated by an operating microscope. To date, only a few case reports have reported locating and obturating a third canal in the mesiobuccal root of the permanent maxillary first molar.

Conventional intra-oral periapical radiographs are an important diagnostic tool in endodontics for assessing the canal configuration. However, it is not completely reliable owing to its inherent limitation. The ideal methods of precise determination of the root canal morphology of a tooth are serial sectioning and clearing of the tooth, which are impractical in clinical situations. Therefore, newer diagnostic methods, such as spiral computed tomography (SCT), are useful to overcome the disadvantages of radiographs by providing three-dimensional images. These imaging techniques have emerged as powerful tools for evaluation of root canal morphology (5).

The purpose of this article is to report the successful identification and obturation of a third canal in the mesiobuccal root of a permanent maxillary first molar with the help of SCT.

Case Report

A 41-year-old Indian male patient complaining of spontaneous pain was referred for endodontic treatment

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of the maxillary left first molar. Clinically, the left maxillary first molar had a deep carious lesion with an intact temporary restoration in place. The tooth was percussion sensitive, cold and heat sensitive, although there was no referred pain. Electric pulp testing (Vitality Scanner, Analytic Technology, Glendora, CA, USA) was indicative of irreversible pulp damage (lingering pain). The patient's medical history was unremarkable. The periodontal condition of the tooth was normal and no pocketing was observed. The panoramic radiograph (Fig. 1) revealed the presence of a deep restoration with recurrent caries encroaching the pulp. After extensive clinical and radiographic examination, the diagnosis of symptomatic irreversible pulpitis with acute periradicular periodontitis was made and the tooth was prepared for nonsurgical endodontic treatment.

Local anesthesia was induced with 2% lidocaine containing 1:80,000 epinephrine (Lignox 2% A, Indoco Remedies, Goa, India). A rubber dam was applied and coronal access was made with Endo Access bur and Endo-Z bur (Dentsply Tulsa Dental, Tulsa, OK, USA). Initially, the mesiobuccal, distobuccal and palatal canals were located. To detect additional canal orifices, the fissure between the mesiobuccal and palatal canals was thoroughly probed with an endodontic explorer (DG-16, Dentsply, Gloucester, UK). A soft and sticky area was located. However, several attempts to introduce a file in these areas were unsuccessful. After troughing the fissure with an L N bur (Dentsply Caulk, Milford, DE, USA) and slow-speed handpiece, a file could be inserted into the groove area. Exploration of the groove connecting the canal orifices was performed with K-file #6, #8 or #10 (Dentsply Maillefer, Ballaigues, Switzerland) and the existence of the MB-2 canal orifice was recorded when a K-file #8 or #10 pushed into the orifice was able to stand by itself. A second soft and sticky area was also located slightly palatal to the MB-2 canal orifice with a DG-16 endodontic explorer.

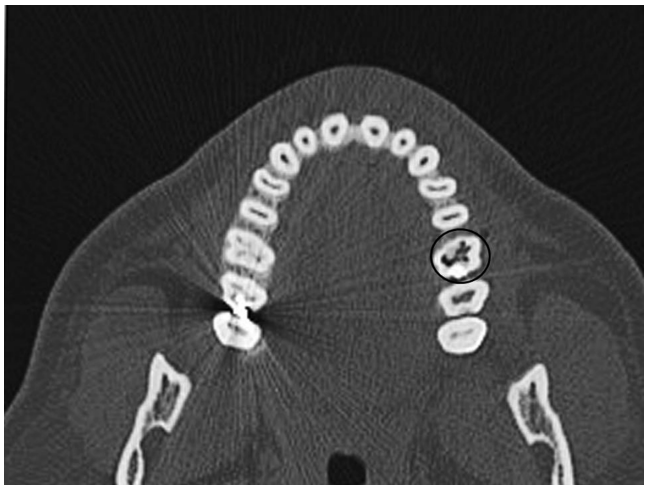
Fig. 1 Preoperative radiograph.

A decision was made to temporarily fill the tooth and give an appointment at a time when a SCT could be used to further investigate the fissure between the mesiobuccal and palatal canals to determine whether the MB-2 was truly in the MB root, and to check for the existence of the MB-3 canal orifice and determine its morphology. SCT revealed the presence of a third canal orifice (MB-3) at the coronal third of the mesiobuccal root. The two lingual-most canals appear to join at the middle third, while the buccal-most canal appears to have its own apical foramen.

A CT scan was performed with SCT scanner (Somatom Balance, Siemens, Erlangen, Germany). All required measures were taken to protect the patient from radiation. Slices of the molar were obtained at different levels to determine the canal morphology. CT scan slices revealed three mesiobuccal canals with three separate orifices and two apices. There was a thin dentinal separation between the MB-2 and MB-3 canals (Figs. 2a, b, c).

Upon careful visual inspection with a surgical loupe (Neitz BLS-3, Tokyo, Japan), a dark line was observed between the MB-2 and the palatal canal orifice of the pulp chamber floor. In this corner, overlying dentin was removed using a diamond bur with a non-cutting tip (Diamendo, Dentsply Maillefer, Surrey, UK) and a third MB canal orifice was detected. The conventional triangular access was modified to a trapezoidal shape to improve access to the additional canals (Fig. 3).

The root canals were explored with a K-file #15. The radiographical length measurement (Figs. 4a, b) was performed with the Rinn set (Dentsply Rinn, Elgin, IL, USA) and confirmed with an electronic apex locator (Raypex 5, VDW GmbH, Munchen, Germany). Coronal flaring was carried out using X-Gates drill (Dentsply Tulsa Dental). The root canals were shaped with protaper rotary instruments (Dentsply Tulsa Dental). The palatal canal was enlarged with protaper F3. The distobuccal and MB canals were enlarged with protaper F2. MB-2 and MB-3 canals were enlarged with protaper F1. During preparation, EDTA (Glyde File Prep, Dentsply Maillefer, North America) was used as lubricant and the root canals were disinfected with sodium hypochlorite solution (2.5%). The canals were obturated with protaper gutta-percha and AH-Plus sealer (Dentsply Maillefer, North America). All the three canals in mesiobuccal root could not be visualized separately after obturation because of the two-dimensional nature of radiographs (Fig. 5). The pulp chamber was sealed with Ketac Fil glass ionomer cement (ESPE, Seefeld, Germany) and the tooth was restored with silver amalgam.



(a)

(b)

(c)

Fig. 2 Spiral CT scan reveals (a) three canal orifices at the coronal third. (b) two lingual-most canals appear to join at the middle third. (c) two canals exit at apical third.

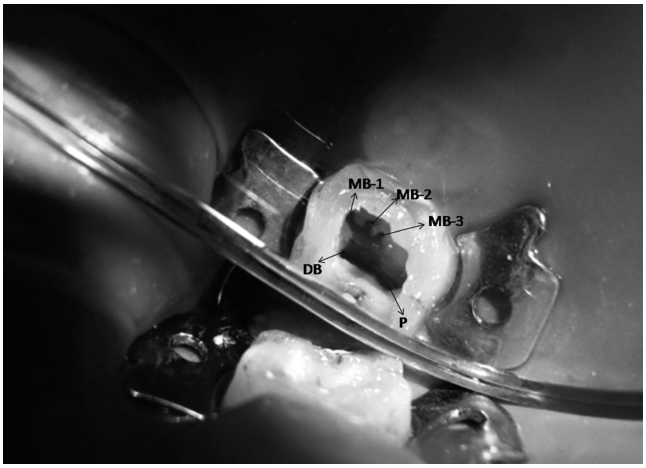
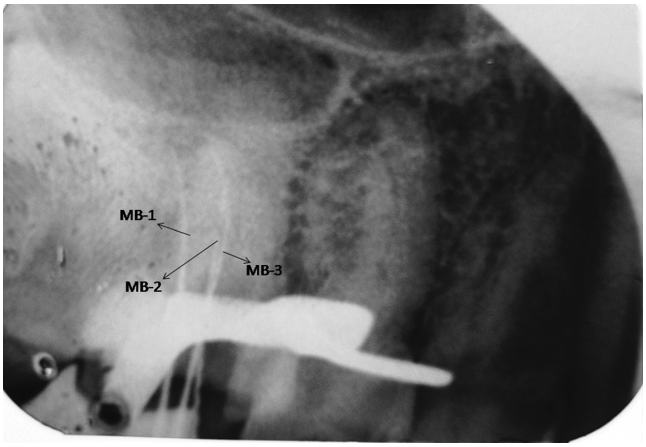
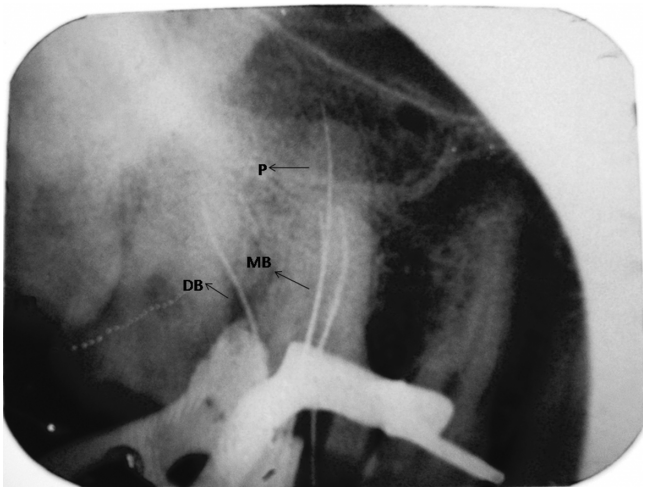


Fig. 3 Occlusal view of the pulp chamber floor with the three canal orifices (MB-1, MB-2 and MB-3) in mesiobuccal root of maxillary first molar.



(a)



(b)

Fig. 4 (a) Working length determination radiograph with three files in mesiobuccal root and (b) Working length determination radiograph with files in mesiobuccal, distobuccal and palatal root.

Discussion

A thorough knowledge of root canal morphology and configuration of maxillary molar teeth is important for the success of endodontic therapy (1,3,6,7). Several studies revealed that the majority of these teeth had three roots, but some articles reported four or five roots with a corresponding number of root canals (8). Zmener et al. (9), Fahid et al. (10) and Jafarzadeh et al. (11) have reported cases with three separate buccal roots. Alani reported a case of bilateral four-rooted maxillary second molars that had two buccal and two palatal roots (12).

Anomalies in root canal morphology need not only be in the form of extra root and fewer roots but also be in the form of extra or fewer numbers of canals. This information is summarized in Table 1. This case report presents an unusual case of a maxillary first molar with three mesiobuccal canals (two lingual-most canals appeared to join at the middle third) similar to the case reports of David B. Ferguson and Amauri Favieri et al. in which two lingual most canals appeared to join at the apical third (13,14). Adanir also reported a similar case with four roots and six canals (8). Sanaa Ibrahim reported an unusual maxillary first molar with six canals: three mesiobuccal, two distobuccal and one palatal. The mesiobuccal canal and the mesiopalatal canal joined at 1 mm of the working length (15).

Martínez-Berná and Ruíz-Badanelli (16) and Beatty (17) reported the maxillary first molar with three mesiobuccal canals (separate canals with separate foramina).

Therefore, reports of cases with unusual morphology have an important didactic value. Their documentation in case reports may facilitate the recognition and successful management of similar cases requiring endodontic therapy. More recently, with the advent of CT and cone beam CT in endodontics, more accurate information can be obtained about root forms of individual teeth.

Treating the extra canals in maxillary first molars may be challenging for clinicians (1,3,7). Inability to find and properly treat the root canals may cause failures. Although the incidence of root and canal variations is rare, dental practitioners must make every effort to find and treat all canals for successful clinical results (8).

This paper highlights the role of SCT as an objective analytical tool to ascertain root canal morphology. The dental CT may become an essential device, like the microscope, ushering in a new era for examination and diagnosis in clinical endodontics.

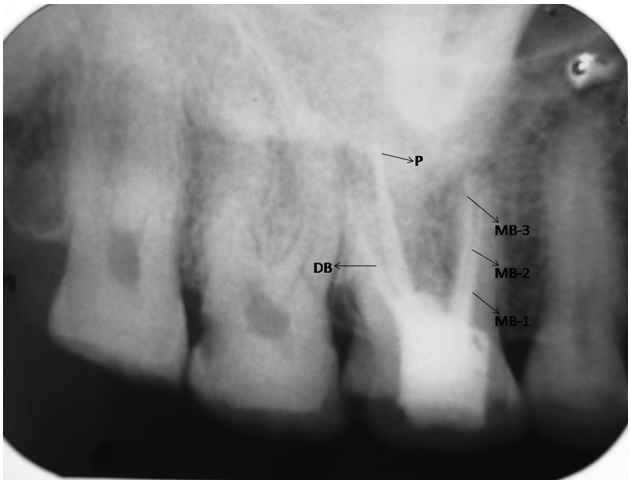


Fig. 5 Postoperative radiograph.

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Table 1 List of reported cases of three mesiobuccal canals of the maxillary first molar

Year	Authors	Canal configuration		
		MB	DB	P
1983	Martínez-Berná and Ruíz Badanelli (16)	3MBs	2DBs/j	1P
1984	Beatty (17)	3MBs	1DB	1P
2005	David B. Ferguson (13)	3MBs/j	1DB	1P
2006	Amauri Favieri et al. (14)	3MBs/j	1DB	1P
2007	Adanir N. (8)	3MBs/j	1DB	2P
2009	Sanaa Ibrahim (15)	3MBs/j	2DBs/j	1P

s: separate canals with separate foramina, j: canals joining in the apical one-third

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